

# Francesco Sorge

PH.D in PHYSICS

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Instituto Nazionale de Fisica Nucleare • Sezione di Napoli

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*Email Correspondence*

July 31 – December 24, 2018

## PREFACE

Professor Sorge was on the *Participant List* for the prestigious *Fifteenth Marcel Grossmann Meeting* which, last year (July 2018) was held in Rome. To almost all of the 800-some participants I sent an email message like the one I sent to Sorge, including my *Gravitational Clock* paper as an attachment. Since the inception of these gatherings in 1975 the purpose has been to “provide opportunities for discussing recent advances in gravitation... emphasizing mathematical foundations, physical predictions and experimental tests.”

During the several weeks that it took to launch this marketing campaign, the traffic on my website increased, and I received a few direct communication nibbles, but none quite so friendly and promising as that from Sorge.

Over the course of our correspondence, I discovered that I already had some of his works in my library. For example, he was a participant in a 2004 symposium on *Relativity in Rotating Frames* [eds. Rizzi and Ruggiero, Kluwer].

Due to Sorge’s explicit receptivity to my initial package of ideas, more quickly than usual, I sent to him additional essays and documents expanding on the background and consequences of my gravity model. Sorge put forth six numbered questions and comments that I subsequently addressed in a separate essay (letter) tailored for the purpose. (I’ve attached that document at the end of the email correspondence, as indicated also on page 5.) The questions themselves and Sorge’s response to my answers indicate that he gave them considerable thought. Sorge’s sense of humor also comes through in his facile adoption of the “Rotonian” point of view.

At the end, after a lapse of a couple months, Sorge sent a brief Christmas greeting. I returned the gesture, and that was it.

Other correspondences included here, and the psycho-sociological analyses sprinkled therein, will likely contribute to the reader’s assessment of the significance of my interaction with Sorge. I should perhaps add that, for all his evident playful open-mindedness, Sorge’s own work suggests a long-term investment in the status quo and virtually no publically discussed doubts about the value or essential correctness of standard theories such as Einstein’s theories of relativity.

In aftermaths such as this—i.e., after a seemingly promising correspondence fizzles out—I always ask myself if any other style or rate of delivering my ideas would have brought about a more positive outcome. Could the dialog possibly have unfolded in such a way that Sorge would enthuse *publically*, to endorse doing Galileo’s experiment? Though I can’t be certain, I tend to doubt it. Scientific scholars sometimes do entertain fringe ideas in their field. Entrenched theories and the corresponding entrenched world views, may well admit incremental adjustments and quibbles over interpretation here and there. But allegiance to the status quo dies very hard, and will not tolerate the kind of upheaval the Rotonians have in mind.

This is true even for those light-hearted ones who may *privately* consider ideas having a deeply subversive character. Even if the validity of such ideas hinges on a simple experiment proposed nearly 400 years ago by the *Father of Modern Science*.

Politicians in USA's Democratic Party are often shown on the TV news telling of their repugnance and disdain for President Trump. They sometimes tell of how their Republican Party colleagues may *privately* express similar reactions. The latter politicians nevertheless—because they are Republicans—*publically* sing Trump's praises and support his policies.

The world is nuts. But the potential to make it sane is still alive. Galileo's experiment must be done. I'm not giving up.

To: francesco.sorge61@gmail.com  
From: Richard J Benish <rjbenish@comcast.net>  
Subject: Testing Gravity  
Attachments: <Gravitational Clock Pt 1.pdf>

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Dear Professor Sorge,

Fascinating and important as it is to study the huge, distant and violent extremes of the Universe, and the most abstract extremities of popular theories involving gravity, I'd like to draw your attention to an unanswered question involving the opposite extremes that are easily accessible in concrete physical reality.

In 1632 Galileo proposed the following experiment: Given a spherical body with a hole through its center, what happens when a test object is released from one end of the hole? The needed apparatus may be called a Small Low-Energy Non-Collider.

A plethora of textbooks, papers, classrooms, and YouTube videos present or simulate the standard answer (harmonic oscillation). Unfortunately, this predicted oscillation has never been observed.

In the attached paper arguments are presented to urge that we satisfy Galileo's empirical ideals by at last building and operating humanity's very first Small Low-Energy Non-Collider.

I would be grateful for any feedback.

Thanks for your good work.

Sincerely,

Richard Benish

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Francesco Sorge, 8/8/18 1:48 AM -0800, Re: Testing Gravity

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From: Francesco Sorge <francesco.sorge61@gmail.com>  
Date: Wed, 8 Aug 2018 11:48:11 +0200  
Subject: Re: Testing Gravity  
To: Richard J Benish <rjbenish@comcast.net>

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Dear Professor Benish,

Thank you very much for your email. I have now read your interesting manuscript. **It seems a quite interesting issue, deserving further investigation.**

I think it is really a severe task to experimentally check Galilei's proposal in a laboratory test: there are a lot of technical difficulties.

Nevertheless, **the idea is undoubtedly stimulating from a theoretical point of view**, and I would be pleased to consider the topic in deeper detail with you, if you agree.

I will think about the issue and I'll let you know about further thoughts in the next weeks. Keep in touch.

Best wishes,

Francesco Sorge

To: Francesco Sorge <francesco.sorge61@gmail.com>  
From: Richard J Benish <rjbenish@comcast.net>  
Subject: Re: Testing Gravity  
Attachments: <Rethinking-Rotation-Sep 5 2012.pdf> <Rethink-Universe-Aug-23-2017.pdf>

Dear Professor Sorge,

I am so glad to have piqued your curiosity. Thank you very much for reading my work.

Moving forward, I would suggest adopting an other-worldly, but quite possible perspective. I think our understanding of gravity may be unduly colored by our privilege of residing on a  $5.97 \times 10^{24}$  kg spherical planet.

Therefore, please imagine the perspective of a civilization that has had no experience with such large concentrations of matter. They have evolved on a large rotating world. (So I call them Rotonians.) They are technologically and mathematically sophisticated, but have no understanding of gravity.

Their theories of motion accommodate the limiting speed of light, but asymmetries in this speed are freely acknowledged (as they are measured in opposite directions around the rim of Roton).

Their most valuable and basic motion-sensing devices are clocks and accelerometers. Of particular importance is that, in their experience, the direction of motion indicated by accelerometers is ALWAYS the same as the direction of the force that causes the acceleration.

With this background, suppose the Rotonians were to encounter an Earth-like ball of matter for the first time. Suppose they manage to softly land on this planet's surface. What would they make of this experience? How would it affect their conceptions of the curvature and dimensionality of space, the nature of matter, the direction of time, and the Universe as a whole?

I've attached two documents that develop these ideas further. I hope you enjoy them and I look forward to your feedback. By the way, I'm not a professor.

Thanks again.

Sincerely,

Richard Benish

From: Francesco Sorge <francesco.sorge61@gmail.com>  
Date: Thu, 30 Aug 2018 15:54:50 +0200  
Subject: Rotonians  
To: Richard J Benish <rjbenish@comcast.net>

Dear dott. Benish

Thank you for the two last papers about the—so to say—**Rotonian issue**. I found both of them quite interesting and suggestive.

Here are some sparse considerations (hoping I understood your papers correctly):

1) Nobody knows the very nature of spacetime inside a spherical matter distribution. You mentioned **the most popular interior Schwarzschild solution** (a perfect fluid with constant proper

density), pointing out the curious different behavior of the space and time metric coefficients, where a non-flat limit result for the time coefficient is reached at the center of the body. To be honest, I don't bother as much about this. The center has a privileged position in space, not in time. In that point the pressure is not zero (actually, it may become infinite in the black hole dynamical limit); hence such point couldn't be considered on equal foots as a point in flat spacetime.

2) Nevertheless, **the issue deserves further investigation**. As you stressed, there are other interior solutions satisfying the spherical symmetry requirements, and an open question is what is the correct one. In that respect **your proposed experiment could undoubtedly represent an interesting test**.

3) According to Rotonians' point of view, acceleration requires motion. So they eventually argue that gravity should imply a kind of motion of space through a new spatial dimension.

4) However, such motion cannot fully resemble that of their rotating world. Rotonians should experience—I suppose—also other non-radial accelerations, as the Coriolis acceleration, which they indeed do fail to detect on Earth.

5) Furthermore, the idea that the origin of gravity could reside in some motion of space through space, assumes that **non-inertial motion is a sort of natural property of space(time)**. In other words, one is led to believe that inertia has nothing to do with matter distribution through the Universe.

6) But, on the contrary, it could be that inertia is dictated just by matter distribution (geometrodynamics? – recall Mach's principle). So what Rotonians do experience could be indeed the manifestation of gravity.

Please, let me know your opinion about the above points.

I'm looking forward to hearing from you soon.

Best wishes,

Francesco Sorge

To: Francesco Sorge <francesco.sorge61@gmail.com>

From: Richard J Benish <rjbenish@comcast.net>

Subject: Re: Rotonians

Attachments: <Sorge Email Sep 12 2018.pdf> <Tubular Array (4+1)-D w Cap.pdf> **This figure also attached at end.**

**Enclosed separately and/or downloadable at gravityprobe.org.** { <FundaGravity Feb 2 2018.pdf> <Maximum Force Nov 17 2011.pdf>  
<Max Force Annotation.pdf> <CosEvthg-Sorge-Sep-12 2018.pdf>

Dear Professor Sorge,

I am very grateful for your interest and your insightful comments. To facilitate formatting of equations, figures, and references, I've put the bulk of my reply in pdf format (attached).

I look forward to another round of questions and comments, if you see fit.

In addition to the attachments explicitly referred to in my reply, I've also attached two other papers that may interest you. One of these is a paper that "almost" got published in the

**See 8-page letter attached at end.**

International Journal of Theoretical Physics, as explained in the *Annotation* (also attached).

Thanks again.

Sincerely,

Richard Benish

P S,

I'm not even a doctor. I grew up on Roton, where they don't confer academic degrees, but encourage independent learning (and a good sense of humor). 😊

R B

From: Francesco Sorge <francesco.sorge61@gmail.com>  
Date: Tue, 18 Sep 2018 19:36:38 +0200  
Subject: Re: Rotonians  
To: Richard J Benish <rjbenish@comcast.net>

Dear Richard,

I would be happy to follow Rotonians' habits, avoiding academic degrees...

So, if you agree, let us call each other by our first name.

Thank you very much for the novel stimulating papers you sent me.

I will be away for a while, attending to a meeting. I'll be back at the end of the month.

I just started reading your last email. There are still several interesting issues making me a bit confused.

Yet, I was very impressed when comparing your ideas with those appeared in Tangherlini's work you cited (see your paper about Maximum Force).

I hope to reply in a short time, as soon as I'm home.

Get in touch soon.

Best,


Francesco

Il giorno mer 12 set 2018 alle ore 19:45 Richard J Benish <[rjbenish@comcast.net](mailto:rjbenish@comcast.net)> ha scritto:

To: Francesco Sorge <francesco.sorge61@gmail.com>

From: Richard J Benish <rjbenish@comcast.net>

Subject: Re: Rotonians

Attachments:  Fig-6-Tang-Shell-Pot-4-2-14.pdf { Attached, page 11. }

Dear Francesco,

Thank you. I am delighted to see that you are eager to not only inquire further into “Rotonian physics,” but to graciously adopt features of their culture!

I am also very pleased that you’ve looked into the *Maximum Force* paper deeply enough to appreciate the Tangherlini connection. A prior correspondent, Tom Martin, was similarly pleased to learn of Tangherlini’s work, as he thought it allowed an extension of his “spatial flow” model of gravity inside matter. There is a longer story behind this, but I’ll simply provide a link to Martin’s paper in which he derives graphable shell solutions based on Tangherlini’s analysis.

<http://www.gravityresearch.org/pdf/GRI-010515.pdf>

Using the latter, I plotted graphs for four cases that serve as a more exact version of Figure 6 in the *Maximum Force* paper. (See attachment and link below.) That earlier graph showed approximately the correct shape, which is however inaccurate with regard to the magnitude and  $r$ -value of the maximum.

<http://vixra.org/abs/1404.0076>

I should add that Martin suspected that the repulsive effect predicted by this interior solution might be physically real. I myself never thought it made physical sense. Evidence later brought to Martin’s attention also convinced him to change his views.

We still need a Small Low-Energy Non-Collider to shed the most illuminating light on what goes on with gravity inside matter.

I hope your meeting is productive and enjoyable. And I eagerly look forward to your comments when you return home.

Best regards,

Richard Benish

**From:** Richard Benish <rjbenish@comcast.net>  
**Subject:** **Re: Merry Christmas**  
**Date:** December 24, 2018 12:24:35 PM PST  
**To:** Francesco Sorge <francesco.sorge61@gmail.com>



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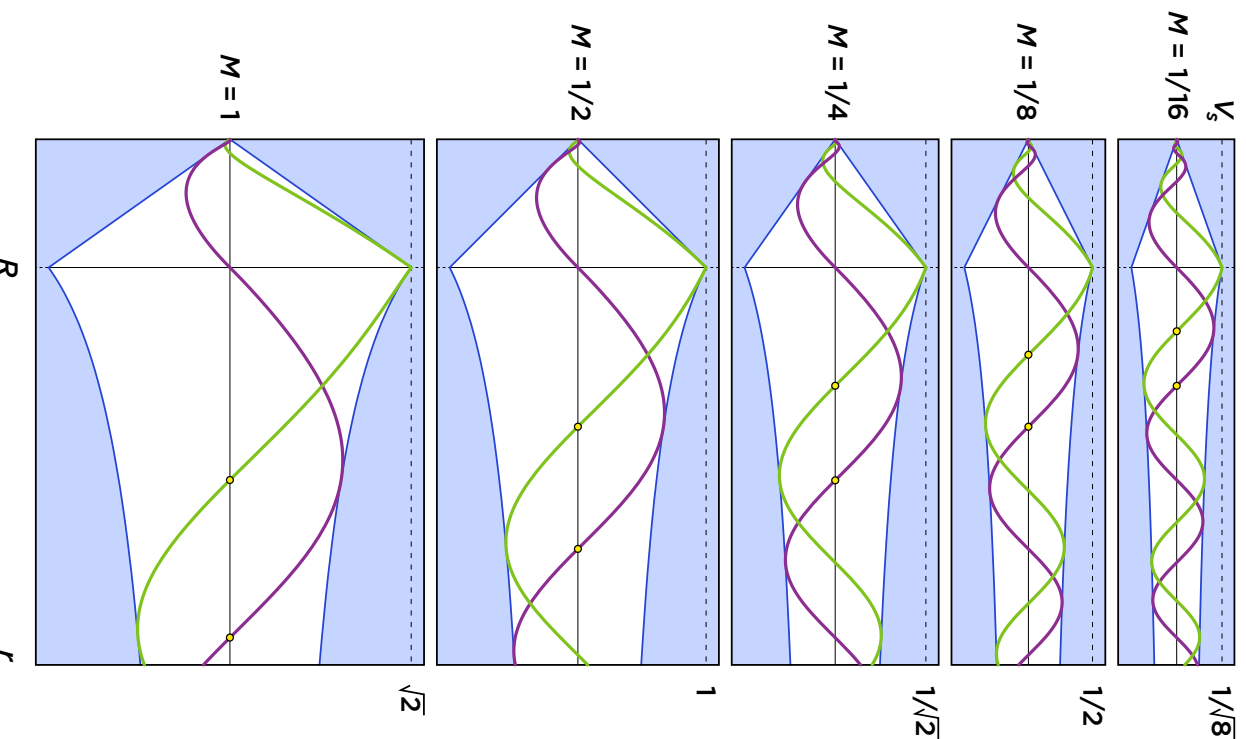
On Dec 24, 2018, at 10:13 AM, Francesco Sorge wrote:

Dear Richard,  
I wish you, and yours, a very Merry Christmas!  
Best regards,  
Francesco

On Dec 24, 2018, at 12:24 PM, Richard Benish wrote:

Dear Professor Sorge,  
And a very Merry Christmas to you and yours as well!  
Happy New Year too!  
Best regards,  
Richard Benish





**Abbreviated Caption:** As the tubes turn, projected intersections of the helices (purple, green) on the axis appear to move toward the origin with the same speed as that of a body freely falling from infinity [ $\sqrt{2GM/r}^{1/2}$ ]. Since all tubes have the same angular speed, the taller ones exhibit correspondingly greater apparent speeds—as also indicated by the correspondingly longer wavelengths. Points on the outer envelope correspond to states of *stationary outward motion*, as exhibited by the tower-mounted clocks and accelerometers depicted in the next figure.

**Comprehensive Caption:** The vertical axis is stationary outward velocity,  $V_s$ . The horizontal axis is radius,  $r$ . Peaks of curves correspond to  $r =$  surface radius,  $R$ . *Density* thus increases with graph height:  $M$  represents a fraction of the arbitrary fiducial mass  $M=1$ . These are to be thought of as cross-sections of tubes, each of which rotates with the same frequency. The purple and green curves are thus helices. Upon turning, these helices project an angle onto the  $r$ -axis that is always  $= 45^\circ$ .

This means that the rotational speed of the tube's envelope is everywhere equal to the speed at which any projected intersection of a helix appears to travel along the  $r$ -axis. For the appropriate rotation direction, this also means, therefore, that the apparent projected speed is exactly that which an object falling radially from infinity would appear to have at any given  $r$ . I call the trajectory of this limit case (the  $r$ -axis itself, also the rotation axis) a *maximal geodesic*.

The corresponding change in speed (outside the surface,  $R$ ) thus corresponds to the acceleration due to gravity  $g$ . Since the stationary outward velocity inside the body decreases to zero at the center, the acceleration of the projected intersection below the surface appears to become "repulsive." This velocity-dependent effect is not to be thought of as any kind of "force," in the traditional sense. An object released into a hole through the center, for example, would still initially appear to have a downward acceleration of magnitude  $g = GM/r^2$ .

Since this object will also never quite reach the center (according to the Space Generation Model) here too the motion eventually slows down, giving the appearance of a repulsion. This is an illusion created by the non-uniformity of the *stationary outward velocity* and *stationary outward acceleration*, both of which are empirically measurable with motion-sensing devices (accelerometers and clocks).

Eventually, the scheme needs to be adapted to explicitly accommodate trajectories of test objects released not only from infinity and the surface, but from any radial distance with any initial radial velocity.

**One of the primary motivations for the diagram is to represent the (4+1)-dimensionality of gravitational stationary motion.** Think of the outer envelope as representing a tall pole planted on the surface of a massive body. Although the pole visually appears to be at rest, accelerometer readings and the rates of clocks tell us that it is everywhere undergoing stationary motion.

If we try to represent this motion in the radial direction in pre-existing (3+1)-dimensional spacetime, the thing flies apart. It is not at all stationary; it is impossible. But if spacetime is in fact (4+1)-dimensional, then we are justified to represent the motion as being "perpendicular" to the pole in the manner shown in the drawing, i.e., perpendicular to the plane of the page.

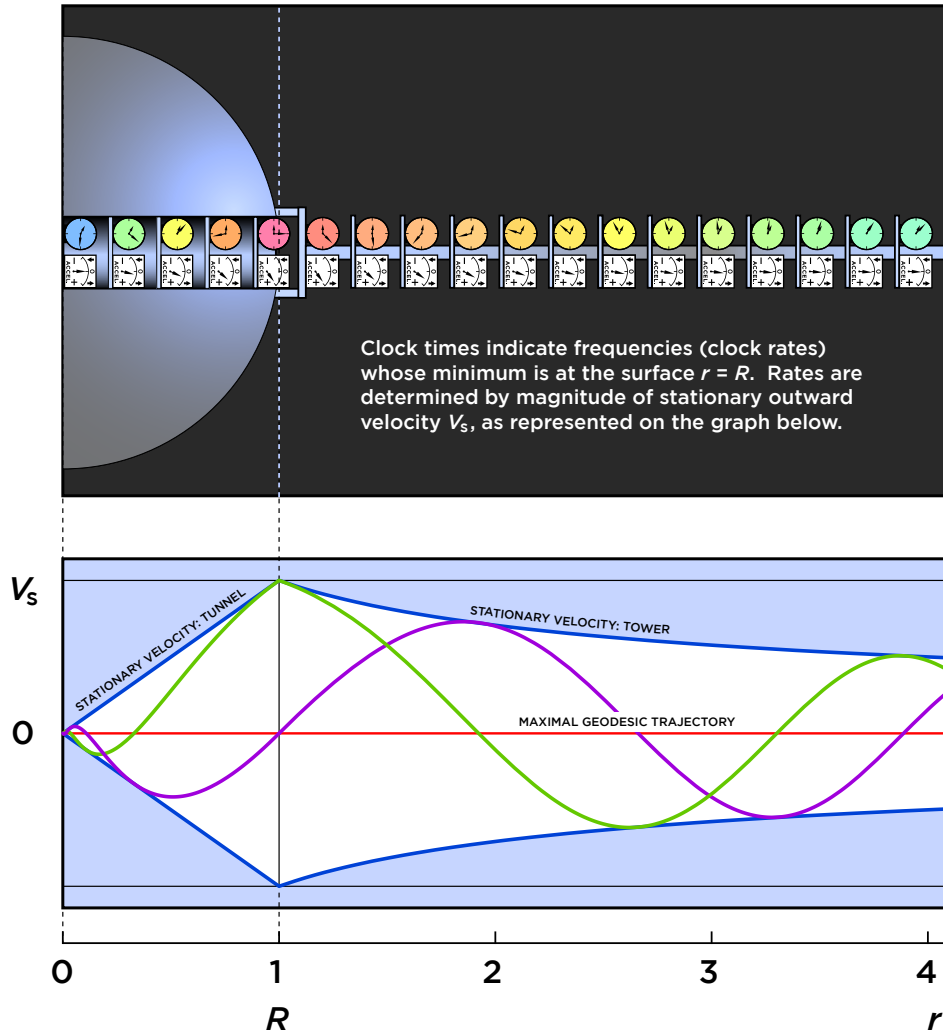
Gravity may thus be conceived as a kind of "rotation" of (3+1)-dimensional spacetime into (or *outfrom*) a new dimension, the magnitude of which depends on the local distribution of mass. As we should expect, we cannot directly see this motion. Since it is manifest empirically by our motion-sensing devices, we nevertheless have reason to expect it to be physically real. In a sense it is more real than our visual impression.

Visually we see falling test objects accelerate. But the accelerometer readings of such objects is zero. Perhaps tactile evidence is more indicative of what is actually happening. Only accelerometers attached to the massive body give positive readings, indicating that **acceleration is a property of matter—exhibiting itself as an inextensible source of perpetual propulsion.** For this to be true, another (fourth) spatial dimension is needed. Evidently, space is being perpetually generated by matter according to the inverse-square law.

Since the rotation period of every massive body "tube" is everywhere the same, it must be related to the value of Newton's constant  $G$ . A more complete representation of the vast range of sizes and masses would show them scaled in terms of the velocity ratio  $V_s/c$ , which would be indicated by a horizontal asymptote (unreachable light-speed maximum).

With such scaling, the tube diameters of common gravitating bodies like stars and planets would be small fractions (small  $M$  values) such that we'd have many helical turns per radial ( $r$ -axis) distance interval, instead of the few turns, as shown here.

The key idea is that this extent in *stationary outward velocity space*, this motion into a hyper-dimension, is the very essence of matter and gravity. An unturning tube collapses to a dead abstract line. Without this state of perpetual outward motion, there would be no gravity, no matter, no space, no time, no life, no Universe.



**Fig. 5** Tubular model of  $(4+1)$ -dimensional radial stationary motion. **Top:** Physical circumstance represented in graph below; i.e., a gravitating body and an imaginary tower attached to its surface. **Bottom:**  $V_s$ -axis represents stationary outward velocity; i.e., the stationary motion of space into or outfrom a fourth spatial dimension. Think of the cross-sectional graph as rotating around the  $r$ -axis. Helices drawn on the tube at  $45^\circ$  to the axis facilitate visualizing the falling motion of maximal geodesics.

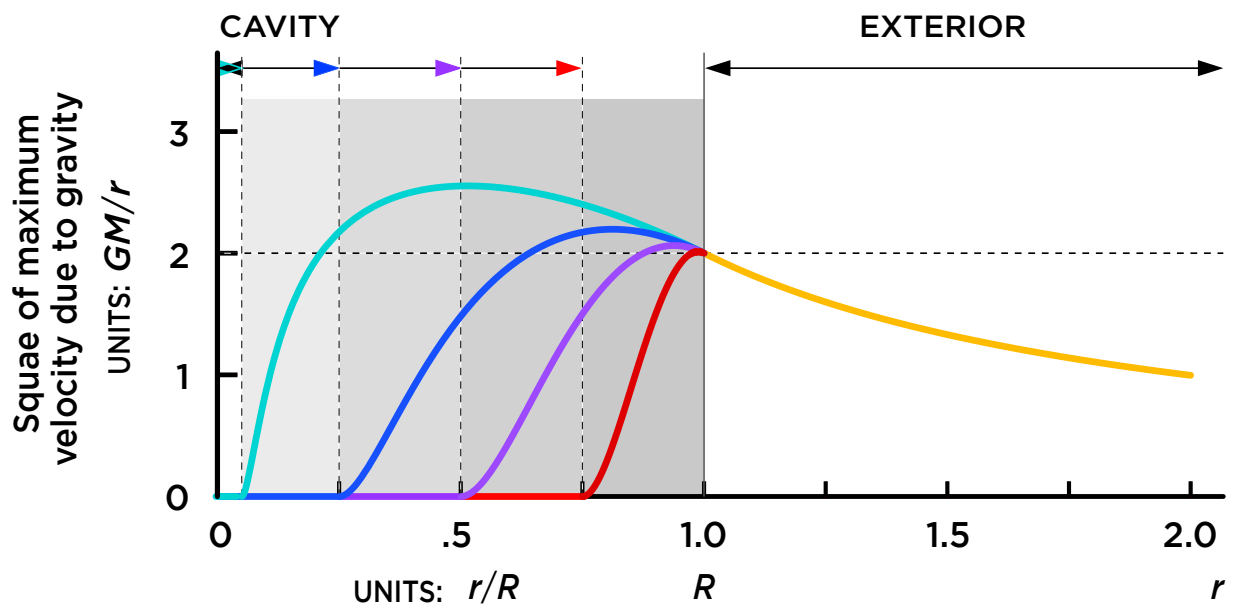


Fig. 6. Tangherlini shell potentials. Outside the shell's surface, gravity abides by the Schwarzschild exterior solution. But inside, the behavior deviates from both Einstein's and Newton's theories of gravity. An object dropped into a hole through the shell from the outer surface or radially falling from the outside to the inside, would never enter the inner cavity. This behavior corresponds to the equations predicting that the rate of a clock inside the cavity is the same as the rate of a clock at infinity.

Figure from *Novel Consequences...* Attached to email message of September 19, 2018 (page 7).

September 12, 2018

Francesco Sorge  
Istituto Nazionale de Fisica Nucleare (INFN)  
Sezione de Napoli  
Complesso Universitario di M. S. Angelo  
Ed. 6 giorni - Via Cintia 80126 Napoli  
Italy

Dear Professor Sorge,

In continuing our email correspondence—especially in response to my papers, *Rethinking Einstein's Rotation Analogy* and *Rethinking the Universe*—you've enumerated six areas of discussion. Your comments seem to exhibit two or three clusters of linked ideas. My response treats #1 and #2 as one group and #3 – #6 as another. I've added one more section that focuses especially on the cosmological implications raised in #5 and #6.

## 1 #1 and #2:

**“The most popular interior Schwarzschild solution” as an idealized starting point to compare with “other solutions” and the Rotonian point of view.**

As has often been pointed out in the literature [1–3], the Schwarzschild interior solution can never be an *exact* representation of spacetime within a massive body because it assumes perfectly uniform density—a condition not physically possible due to inevitable non-uniform pressure caused by non-uniform gravitational force. The solution is nevertheless useful as a point of reference from which to discuss expected deviations from its exact unphysicality. Most of these discussions concern astrophysical bodies such as neutron stars.

I am sometimes amused by the wide range of theoretical possibilities often characterized by the mass/radius graphs representing different equations of state, with their multitude of bird-like s-curves, bounded by the dread singularity. (See Figure 1.)

Be that as it may, for our purposes we are presently concerned only with *ordinary* bodies of matter having densities similar to our own (or within a few orders of magnitude). In the weak-field (ordinary body) regime these astrophysically motivated variations all reduce to the Newtonian limit, where the *potential* and corresponding *mass defect* are as predicted under the *assumptions* that gravity is a force of attraction and that the rates of clocks are a *minimum* at the center. I question all of these variations by proposing a singularly drastic departure according to which gravity is *not* a force of attraction and clock rates approach a central *maximum*, not minimum.

The volumes of work involving the strong-field, high-pressure situation might ultimately prove to be premature and misguided because *we have not yet confirmed the weak-field, zero pressure situation*. Astrophysicists claim to have made sensible models of exotic stars prior to validating our understanding of gravity inside a common lump of coal. Rotonians are not uncurious about neutron stars, but their sense of priority dictates the need to first explore the

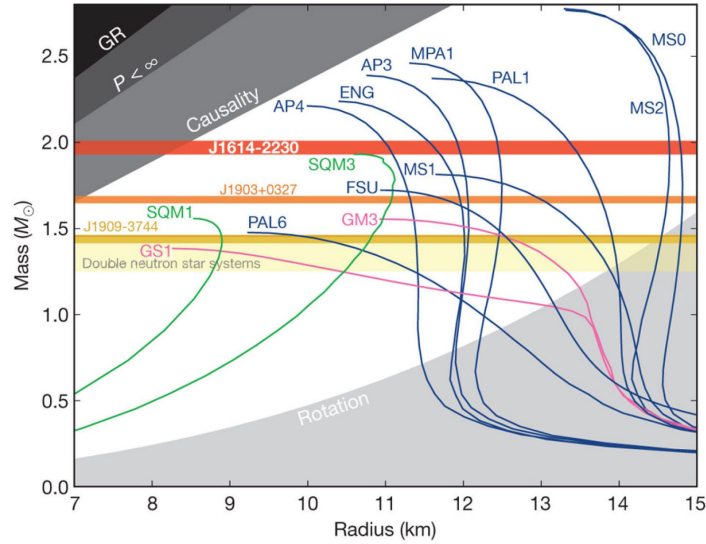


Figure 2.1: NS mass-radius diagram for various EoS (see [Demorest10] for details). The horizontal bands in red, orange and dark yellow show the current observational constraints from several pulsars while in light yellow for double NS binaries. Any EoS line which does not intersect the red band ( $m_{\text{NS}} = 1.97 \pm 0.04 M_{\odot}$ ) is ruled out. Reprinted from [Demorest10].

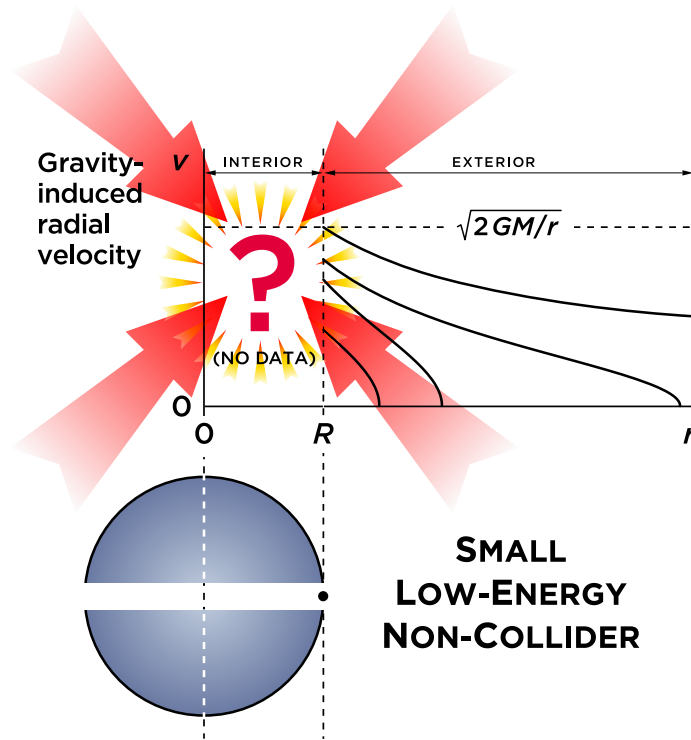
**Figure 1:** Equations of State determine the mass-radius relation of neutron stars. Might such pretty graphs be as embellishments on snarks and unicorns? Before taking them seriously ought we not to first confirm the underlying theory's validity inside ordinary, accessible bodies of matter? From Schlögel 2016. [4]

gravitational behavior of a much smaller (easily manufactured) body with a hole through its center. In this case the pressure in the hole is zero. Yet Earthians say a clock at the center ticks slower than all the rest. Why? What causes that?

The only thing that causes clock rates to deviate from a maximum rate, in the Rotonians' experience is *motion*. In a concentric evacuated cavity, or in a tube through the center of a gravitating body there is no matter to cause any motion. So why should a clock there tick slower than one on the surface? Is it scientifically acceptable to merely *assume* the Earthian prediction is true, or should we seek to test it by experiment?

For laboratory-sized bodies of matter the difference in clock rate, as between the center and the surface, is so small as to be immeasurable. Central to this discussion, however, is the idea that the clock rate question is indirectly—though convincingly—testable by observation of *motion* that the clock rate is theoretically correlated with. In other words, *the big red question mark pertains to both questions*: Motion though the center and clock rates inside ordinary bodies of matter. (See Figure 2.)

Even though doing Galileo's experiment would answer both questions, physicists typically assume instead that both questions have been sufficiently *answered by theory*. This approach—to leave the base assumption physically untested—is sloppy science. Theory is not capable of definitively answering empirically questions. If he were alive today, would Galileo be satisfied with *pretending* to know the result of his experiment or would he insist on actually doing it?



**Figure 2:** Huge gap in gravitational data. Though discussions of the interior falling experiment that would replace the question mark with data are common in physics classrooms and in the literature, it has never been done. The results are therefore unknown, as indicated (with some modest exaggeration).

Your acknowledgment of our ignorance of the answers to these gravitational questions and agreement that they should indeed be answered by experiment is much appreciated.

## 2 #3 – #6:

**Motion *through* space vs. motion *of* space. Limits of analogy. Spatial dimensions and spacetime curvature. Implications for the “origin of inertia.” Mach’s Principle and the Universe.**

I’m delighted that you’ve taken hold of the idea—crucial to the Rotonian conceptions of mass, space, and time—that we can meaningfully distinguish between motion *through* space vs. motion *of* space.

By contemplating the possibility that Einstein’s approach to his rotation analogy was backwards, Rotonians come to clearly see not only the limits to the analogy (i.e., where the compared cases diverge) but also the new ideas needed to uphold the analogy’s validity to the greatest extent possible. It all traces back to Rotonians’ instinctive belief in the truthfulness of accelerometer readings.

Rotonians see it as nonsensical to adopt Einstein's view that rotating bodies can be regarded as *static*. The measurable effect on clocks, rods, and accelerometers due to uniform rotation *means* the same measurable effects found with respect to massive bodies are to be explained by the *same cause*, i.e., motion.\*

This "sameness" cannot reasonably be expected to be exact because the situations are clearly different. Analogies are obviously not identities. Uniform rotation is an everyday occurrence which we scarcely think of as needing the qualification: *motion through space*. What other kind of motion is there?

Our answer is more clearly understood by appeal to another analogy. In this case we consider the experience of an imaginary sub-dimensional, though intelligent life-form whose experience leads to the same question. Thinking of their world as a plane wherein motion is only possible in two dimensions, inhabitants of this world eventually discover that a long enough "straight" line returns to its starting point. How do they explain this? Being mathematically savvy, they deduce that it indicates the flatness of their plane to be a local illusion. They actually live on the surface of a sphere which extends into another dimension.

Prior to circumnavigating their world, these folks had already noticed that when triangles drawn on their surface are large enough, they exhibit deviations from Euclidean (plane) geometry. The sums of the angles exceed  $180^\circ$ . Rotonians thus discovered the need for a non-Euclidean ("curved") geometry. And only later—after their circumnavigation added inescapable clarity to the picture—did they begin to conceive the *connection* between curvature and higher dimensions.

I think our experience as seemingly  $(3 + 1)$ -dimensional beings residing on a seemingly static sphere of matter is analogous to the above scenario. Thanks to Einstein and his followers, we now have an abundance of evidence indicating that our world is most accurately described by non-Euclidean geometry. I think spacetime curvature is a firmly established empirical fact. These non-Euclidean conceptions are routinely described in the context of gravitational physics. The prevailing theory of gravity (General Relativity) that accommodates spacetime curvature also purports to explain accelerometer readings and distortions of space and time as being due to an essentially *static* picture of matter, having no need for more than  $(3 + 1)$  dimensions. One of the quirky (and, Rotonians think, highly questionable) consequences of this development is the appearance of intuitively contradictory expressions such as "gravitational acceleration of a particle at rest." [Möller, Rindler]

Meanwhile, arrays of accelerometers all over the world perpetually *scream*: We are moving! We are accelerating upward! Their motion is not the common, visually apparent circumstance of motion through space. Earthians are blind and numb to regard it as motion at all because of their habitual refusal to believe their motion-sensing devices. Whereas Rotonians—who have learned to deeply trust their motion sensing devices—see and feel the motion clearly: It is the motion *of* space into (or outfrom) a fourth spatial dimension. Matter is obviously not static; it produces the "gravitational field" by perpetually generating space and regenerating itself. Matter is thus conceived as an inexhaustible source of perpetual propulsion.

Rotonians see their proposal to test their hypothesis as being analogous to the two-

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\*Newton's *Rules of Reasoning in Philosophy* state: "Nature does nothing in vain, and more is in vain when less will serve; for Nature is pleased with simplicity, and affects not the pomp of superfluous causes. . . . Therefore to the same natural effects we must, as far as possible, assign the same causes." [5]

dimensional creatures' proposal to follow a "straight" line as far as they could. Just as proof of the existence of a *third* spatial dimension was provided by traveling all the way *around* their "locally flat" surface, proof of the existence of a *fourth* spatial dimension may be forthcoming if only Earthians would see fit to arrange for a test object to forcelessly travel all the way *through* a seemingly static  $(3 + 1)$ -dimensional chunk of matter. Geodesic travel around a sphere proves the existence of the third spatial dimensions. The attempt to geodesically travel through a massive sphere proves (according to the Rotonian hypothesis) the existence of the fourth spatial dimension, because a rocket will be needed to get back up to the opposite side.

Rotonians suspect the test object will not pass the center, indicating that the force of gravity (disregarding tidal effects) is conveyed only by contact with the material source of space. The apparent pattern of motion of objects over the surface is due to the inverse-square law by which space is generated, and to the curvature of that space due to the limiting speed of light and as manifest by the slowing of clocks and radial shortening of rods.

Among the attachments you will find one—Tubular Array  $(4 + 1)$ -D—that augments the above discussion by referring to a set of  $(4 + 1)$ -dimensional rotating tubes, similar to those depicted in Figure 1, *Rethinking Rotation*, and Figure 5, *Rethinking the Universe*.

### 3 #5 – #6:

#### "Origin of inertia." Mach's Principle and cosmic implications.

You will notice that the final sentence of the long caption to the just-mentioned attachment asserts that the stationary motion deduced by the Rotonians is the *essence* of matter, without which we would obviously not have a Universe.

Before delving too far into a discussion of these cosmic matters, it is pertinent to recognize what a foggy muddle has often been made of them in the literature. The principle by which Einstein is sometimes credited as having identified inertia with gravitation (*Equivalence Principle*) has been characterized as being so vague (by having been stated in too wide a variety of indefinite ways) that "There are almost as many equivalence principles as there are authors writing on the topic." [6] The same can be said for "Mach's' (alleged) Principle." An "Index of [*twenty-one!*] Different Formulations of Mach's Principle" is included in Barbour and Pfister's book on the subject. [7]

This dubious state of affairs (about which much more could be said) gives Rotonians the impression that, above all else, Einstein was a great salesman.

Curiously, as is often the case with innovative thinkers, even if a coherent picture has not yet emerged, kernels of truth may yet be contained in their ideas so as to render them worthy of inspection from as yet unexplored perspectives (e.g., that of the Rotonians). Being fresh and virtually unencumbered by the weight of Earthian gravitational dogma, Rotonians take a special interest in Newton's gravitational constant  $G$ . Most significantly, they notice that Earthians haven't the foggiest idea how this fundamental constant relates to their wide assortment of other interrelated constants. Surely  $G$  must ultimately be interrelated in a similar way; surely it must somehow be expressible as a combination of the others.

Many details will be left out here. But it is worthwhile to point out that conceiving  $G$  as a fundamental *acceleration of volume per mass* is conducive to relating inertia to cosmology in, I



think, a rather elegant way. Skipping directly to the end product, Rotonians have come upon the following very nearly (at least) empirically true expression:

$$G = 8 \left( \frac{\rho_\mu}{\rho_N} \cdot \frac{c^2 a_0}{m_e} \right), \quad (1)$$

where  $\rho_\mu$  is the mass-equivalent of the CBR energy density,  $\rho_N$  is the nuclear saturation density,  $c$  is the light speed constant,  $a_0$  is the Bohr radius, and  $m_e$  is the electron mass.

Concerning the persistent disconnect between  $G$  and the rest of physics, I. J. R. Aitchison speculated: “Could the dimensions of Newton’s gravitational constant be explained [by] . . . a theory of gravity characterized by a fundamental mass (or length) and a dimensionless strength? Could we then unify *all* the forces?” [8] Note that Eq (1) satisfies all of Aitchison’s desiderata.

If Eq (1) is true—so as to validate the gist of the Rotonian conception—one of the first consequences to consider is the implied unification between inertia and gravity. Inertia, the resistance a body poses to acceleration in *one* direction (line) is due to and is essentially the same thing as gravity, the *process* by which material bodies generate space in *every* direction (volume).

The connection to cosmology is facilitated by contemplating another contrast to the standard view. Einstein’s cosmological constant, which represents the accelerative creation of space out of *nothing*, has a positive value in deSitter’s famous cosmological solution of 1917. Because this solution entails an exponential cosmic expansion, its metric was adopted by the Steady State cosmologists of the 1950s. It has been reincarnated in modern times as the state to which the cosmos supposedly approaches asymptotically, as the “attractive” influence of matter shrinks toward zero, as compared with the ultimate domination of the Universe by the ever-more cold and repulsive vacuum of space.

One of the reasons Rotonians are unimpressed (if perhaps a little tickled by its irony) with this scheme is that it perpetuates the imaginary discontinuity between matter and space with regard to what expands and what does not. That is, what “tries” (but fails) to pull things back together (static matter via attractive gravity) and what (supposedly successfully) increases the distances between them (“dark energy”). Surely this is a most inelegant (ugly) conception of the Universe.

I suppose you already anticipate the Rotonian alternative: We don’t need a cosmological constant because there is no gravitational attraction. *Matter* is the generative, active source of the Universe’s exponential expansion.

Perhaps you are familiar with Robert Dicke’s efforts to understand Mach’s Principle’s connection to particulate matter. (Dicke is listed as the 19th entry in Barbour and Phister’s *Index*.) In his 1964 essay, *The Many Faces of Mach* [9] after presenting the commonly encountered Mach’s Principle-based cosmic equation:  $GM/Rc^2 \approx 1$ , Dicke entertains the idea that:

A scalar field, generated by all the matter in the universe and acting on the particles in the universe, could conceivably affect all their masses in such a way as to keep  $M/R$  constant . . . the masses of the particles would adjust themselves appropriately, in such a way as to give  $M/R$  the appropriate value.

It is as though the Universe is a giant servosystem, continuously and automatically adjusting particle masses to the value appropriate to the feedback condition

$$\frac{GM}{Rc^2} = 1. \quad (2)$$

Dicke continues by suggesting a connection to a few of the "Large Numbers" coincidences as expounded upon by Dirac. These "coincidences" also play a role (where they are found to be not coincidental, but profoundly meaningful) in Rotonian cosmology.

Even though Dirac's and Dicke's conceptions of gravity were quite unlike the Rotonian conception, we nevertheless find this curious "kernel" of overlap as regards cosmology and the possible interplay between the cosmically small and the cosmically large. According to Rotonian cosmology, the global *feedback* field consists in the connection—via the fine structure constant—to the nuclear saturation density and a possible maximum matter density, both of which play a role in maintaining cosmic proportions (i.e., masses of particles, the value of Newton's constant, the cosmic scale length, among others). Just as nuclear forces "saturate" to balance electromagnetic forces in an atomic nucleus to maintain stability, Rotonians conceive the Universe as being *saturated* by the unifying effect of all the forces (giant servosystem?) whose prominent large scale manifestation is gravity.

I've attached a Cosmic Everything Chart which compactly graphs some of these connections. For more details, see also my long essay: *Light and Clocks* [10].

In closing, I should say that, much more important than the validity (or not) of these wild ideas, is the fact of the ever-beckoning big red question mark. The spirit of Galileo still waits for his experiment to be done. We have yet to build and operate humanity's very first Small Low-Energy Non-Collider. If the result is that the test object oscillates, then we can safely disregard most of the above ideas. But if the result agrees with the Rotonian prediction, humans will have a fun time reassessing everything!

Once again, many many thanks for taking an interest in Rotonian physics.

Cheers,

Richard Benish

PS,

On the attached Chart, please note the datum between Melon and Elephant. ☺

RB

## References

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